

This fine mole-rat, which I have named in honour of its discoverer, is no doubt nearly allied to *G. ochraceo-cinereus*, Heugl., with which it shares its chief cranial characteristics. But its colour is of the slaty grey found in *G. lechei*, and quite unlike the sandy or ochraceous of Heuglin's species.

LXIX.—*The Genera of Recent Clypeastroids.* By HUBERT LYMAN CLARK, Museum of Comparative Zoology, Cambridge, U.S.A.

ALTHOUGH the classification of the sea-urchins commonly called cake-urchins, sand-dollars, and keyhole-urchins has engaged the attention of many zoologists, some of whom have held very high rank, the nomenclature in use at the present day is very unsatisfactory. That which is used by palæontologists differs from that of their brethren who confine their work to Recent forms, and such a name as *Echinanthus*, for example, means something quite different in one field from what it does in the other. The difficulties seem to arise chiefly from the fact that leading echinologists, such as the two Agassizs, Duncan, and Lambert, have refused to accept the tenth edition of the 'Systema Naturæ' as the starting-point in nomenclature, but have dated both genera and species from pre-Linnean writers. Other articles of our present International Code of Nomenclature have also been consciously or unconsciously violated, and thus the confusion has been made worse.

Having had occasion recently to outline for my own use a consistent and satisfactory classification of the Recent Clypeastroida, I have found that the application of the International Code results in some important changes; and as I believe these changes are bound to be made ultimately, they had better be suggested at once. Fortunately few familiar names are altered, and none of these is likely to cause any confusion. Of course, those who persist in the maintenance of pre-Linnean names cannot accept my conclusions, and I shall not expect it; but I do hope that those who wish to obtain a reasonable stability of nomenclature through the general acceptance of the International Code will find themselves able to accept the types here given for the different genera, even if their own methods or preferences would have led them to different results. I hope it is needless to add that if I err in the application of the code or in the

statement of any case, I shall consider it a great favour to be promptly corrected.

In the tenth edition of the 'Systema Naturæ' Linné includes in his genus *Echinus* four nominal species (*rosaceus*, *reticulatus*, *placenta*, *orbiculus*), which it is universally agreed are clypeastroids. The references and figures which he cites under each name show that these species, with the exception of *placenta*, are composite groups, and not species as we understand the term to-day. The form named *Echinus placenta* is, however, a well-known East-Indian species, and there is not now and never has been any doubt as to its identity. The name *rosaceus* has been the source of much confusion, and unfortunately Lovén, in his very important and valuable work on the Echinoidea described by Linné (1887, Bihang Kgl. Svenska Vet.-Akad. Handl. xiii.), has not helped matters at all, because, as pointed out by Lambert (1905, Ann. Univ. Lyon, n. s. i. p. 142), he overlooked Lamarck's work published in 1801, which has an important bearing on the matter. As Lovén admits there is no authentic type specimen of *rosaceus*, we must judge of the species by what is published in the 'Systema Naturæ'; and there can be no doubt that the diagnosis and references given there (ed. x. p. 665) show conclusively that the name covers a composite group, including species of *Echinanthus*, *Clypeaster*, and *Laganum*, as those genera are used by A. Agassiz in the 'Revision of the Echini.' Leske (1778, Add. ad Klein) failed to differentiate these various forms satisfactorily, but elects to call the group *Echinanthus humilis*, admitting at the start that his name is a synonym of *rosaceus*. Lamarck, however, in 1801 (Syst. Anim. s. Vert. p. 342), recognizing the composite nature of *rosaceus*, restricted that name to the West-Indian species called in the 'Revision' *Echinanthus rosaceus*, and placed it as the first of two species in a new genus, *Clypeaster*. The other species (*pentapora*) he removed in 1816 to *Scutella*, and so *rosaceus* must be the type of *Clypeaster*. I fully agree with Lambert that Lovén's attempt to restrict the name *rosaceus* to the "species of the Eastern Seas, commonly named *Clypeaster placunarius*," is not only unconvincing and belated, but is most unfortunate.

What, then, becomes of the name *Echinanthus*? I regret that I cannot answer this question in agreement with either Lambert or Duncan. The reason, however, is obvious. They both go back to a pre-Linnean authority. Under the Code, which I am trying to follow, the fate of *Echinanthus*, Leske, the first post-Linnean writer to use the name, is

casily determined. Leske included only four species in his genus (*humilis*, *altus*, *ovatus*, *orbiculatus*), and of these *humilis* equals *rosaceus*, L., and with its near relative *altus* belongs in *Clypeaster*, where they were placed by Lamarck. In 1825 Gray removed *ovatus* to his new genus *Echinolampas*, and therefore *orbiculatus* alone is left to be the type of *Echinanthus*. As this species is generally agreed to be a *Pygurus*, Agassiz, the latter name becomes a synonym of *Echinanthus*, unless it contains, as established by Agassiz, one or more species not congeneric with *orbiculatus*, Leske.

If, then, the name *Echinanthus* is no longer available for a clypeastroid, and if *Clypeaster*, Lamarck, must replace *Echinanthus* as used by A. Agassiz, what is the proper name for the group called *Clypeaster* in the 'Revision'? Personally I think it is practically impossible to separate the two groups. It is true that the internal structure of the test of *rosaceus* is strikingly different from its West-Indian ally *subdepressus*, Gray; but one cannot separate the Pacific forms by a corresponding difference, and I think we must consider the condition in *rosaceus* as simply a specific character. There can be no doubt that increasing age brings an increasing amount of calcareous matter for deposit in the test of clypeastroids, and we must therefore be on our guard against placing too much weight upon characters shown by the internal structure of the test. If, however, it is desirable to distinguish *rosaceus* generically from its nearest allies, the latter may bear the name *Stolonoclypus* proposed by A. Agassiz in 1863. The type of this genus I will here designate as *Clypeaster prostratus*, Ravenel, = *Echinanthus subdepressa*, Gray.

The species called *reticulatus* by Linné is a more inexcusable composite than *rosaceus*, as it is made up of two utterly unlike clypeastroids: one is *rosaceus* itself, as clearly shown by Sloane's figures to which Linné refers; while the other, indicated by references to Gualthieri's pl. ex. fig. D, is the little Indo-Pacific species long known as *Clypeaster scutiformis* (Gmel.). The difference in Linné's diagnoses of *rosaceus* and *reticulatus* is so trivial that it needs no consideration. Lovén's attempt in 1887 (*l. c.*) to delimit *reticulatus* was anticipated over a century earlier by Leske, who, in 1778, clearly restricted the name *reticulatus* to the Indo-Pacific form. As A. Agassiz showed this in the 'Revision,' I am at a loss to understand why he preferred the later name *scutiformis*.

Returning again to Linné's list, we find the fourth species (*orbiculus*) recognized as a composite by its author, who

divides it into four varieties or forms. Fortunately the references to figures under these forms are sufficiently consistent, so that it is easy to determine to what species each form is to be referred. Leske recognized this fact, and gave each form a new name. He first selected the third one, and called it *Echinodiscus quinquiesperforatus*; next he removed the fourth form as *Echinodiscus orbicularis*; next comes the second, which he called *Echinodiscus deciesdigitatus*. The name *orbiculus* is thus left for the first form alone, and Leske's name *dentatus*, which he gave last of the four, must be regarded as a synonym. As Agassiz in 1841 placed this species (under a pre-Linnean name) in his genus *Rotula*, where it has since remained, it becomes the type of that genus by virtual tautonymy, if for no other reason.

The first post-Linnean writer whose work affects clypeastroid nomenclature is Leske, 1778. The idea of dating *Echinocyamus* and *Echinoneus* from Van Phelsum, 1774, seems to me absurd. It is true that he uses both names, but he is not a binomial writer, his diagnoses are inadequate, and he gives no species under either "genus." Even if we wished to, we could not use generic names which are neither adequately diagnosed nor assigned any constituent species. The question whether we accept these names of Van Phelsum or not is unimportant, however, for our nomenclature will not be affected, but only the date and author of the two names*. It may be added that if we are to date these names from Van Phelsum, then Agassiz's name *Heliophora*, proposed in 1840, has precedence over the universally used name *Rotula*, Agassiz, 1841. *Heliophora* has been rejected, and rightfully it seems to me, because it has no constituent species, and therefore cannot be assigned a type; and this is the status of *Echinocyamus* and *Echinoneus* of Van Phelsum. For my part I do not see how, under the Code, such genera can be maintained. Under Article 30 we read—"In no case . . . can a species be selected as type which was not originally included in the genus"; and I do not see how one can determine what species are included in a genus, where no species at all are mentioned, unless, indeed, the diagnosis is exceptionally exact.

Leske (1778, Add. ad Klein) groups his clypeastroid

* Mortensen's argument (1907, 'Ingolf' Ech. pt. 2, p. 38) seems to me sufficient to dispose of Lambert's most unwelcome attempt to upset the hitherto universally accepted usage of the names *Echinocyamus* and *Fibularia*. But personally I cannot consider Van Phelsum entitled to consideration in this matter.

species in four genera—*Echinodiscus*, *Echinanthus*, *Echinocyamus*, and "Genus 1." The fate of *Echinanthus* with its constituent species has already been discussed. The determination of the type of *Echinodiscus* is by no means easy. Lamarek ignored the genus, but Gray (1825, Ann. Phil. x.) accepted it and only removed one of Leske's fifteen species. This one (*E. laganum*) he placed in a new genus, which he called *Lagana*, a misprint (as shown by his quotation from Klein) for *Laganum* *. By tautonomy Leske's species becomes the type of the genus. Blainville (1830, Diet. Sci. Nat. lx.) used the name *Echinodiscus*, but as he did not include even one of Leske's fifteen species, his work can hardly be said to help in the selection of a type. However, he correctly placed Leske's *E. orbicularis* in Gray's genus *Laganum*. It was not until Agassiz's monograph 'Des Seutelles' appeared in 1841 that Leske's heterogeneous group was broken up. Of the thirteen species still in *Echinodiscus*, Leske, in 1841, we may dismiss *rosaceus* as unrecognizable, and probably not an echinoid, while *reticulatus* is clearly a *Clypeaster*. Of the eleven remaining species Agassiz puts *dentatus*, *octiesdigitatus*, and *deciesdigitatus* in his new genus *Rotula*; for *quinquesperforatus* and *sexiesperforatus* he establishes *Mellita*; *emarginatus* and *quaterperforatus* he included in his genus *Eucope*; *bisperforatus*, *auritus*, and *inauritus* he called *Lobophora*; and *subrotundus* he places first in the Lamarckian genus *Scutella*. As this is the only one of the species placed in *Scutella* by Lamarck, which Agassiz also places in that genus, it is certainly desirable, if not absolutely obligatory, to consider it the type. It will be noticed that Agassiz makes four new genera out of Leske's *Echinodiscus*, but ignores the name. Of the four genera *Lobophora* is the last established, and ought therefore to bear the old name; and this is peculiarly fortunate, for the name *Lobophora* is preoccupied and could not therefore be used. A. Agassiz first called attention to this in the 'Revision,' and restored Leske's name to the genus. No type has ever been selected, and I therefore choose *E. bisperforatus*, Leske, second variety, which "longiora et angustiora linearia que foramina offert." I specify this variety because the other was named *Lobophora truncata* by Agassiz (1841); and although Fourtau (1904,

* The attempt to date this name from Meuschen, 1787, seems to me most unfortunate. He is not a binomial writer, and I have no patience with revising the names of his catalogue. Many familiar Echinoid names must take on a new meaning if his work is to be accepted.

Bull. Inst. Egypt, (4) iv.) confirms A. Agassiz's view that the two are identical, it is desirable to have decided which is the typical form.

Leske's genus *Echinocyamus* contains thirteen nominal species, all based on Van Phelsum's figures. Lamarek (1816) includes the same group, so far as he recognizes them at all, in his genus *Fibularia*. The two names were used interchangeably for many years, some writers using Leske's and others preferring Lamarek's, until, in 1847, Agassiz and Desor (Ann. Sci. Nat. (3) vii. pp. 140-142) restricted *Echinocyamus* to the flat forms ("Oursins plat") and *Fibularia* to the high ones ("Forme subsphérique ou ovoïde"). As *angulosus* is the only one of Leske's thirteen species which they mention, and as it stands first in their list of *Echinocyamus* species, it may well be considered the type of that genus. Under *Fibularia* they mention two of Lamarek's species, *ovulum* and *trigona*; but as the former is now generally considered a synonym of the latter, *trigona* is doubtless the type of the genus.

Were the history of the name *Echinarachnius* exactly as recounted in the 'Revision of the Echini,' it would be impossible for us to retain it for the sand-dollars in the sense in which it has been used for seventy years; but fortunately quite another interpretation of Leske's use of the name than that given in the 'Revision' is not only permissible, but is apparently more reasonable. On p. 153 of his 'Additamenta ad Klein' Leske refers to a clypeastroid under a "Genus 1" which he says Van Phelsum called *Echinarachnius*, and on the next page (154) he describes it as "Species 74, *Echinarachnius*." Further on he says it is identical with *Echinus placenta*. L. Van Phelsum, however, did not call the animal *Echinarachnius*, and on p. 8 Leske himself translates Van Phelsum's colloquial name as *Arachnoides*, which is Klein's "Genus unicum" and obviously Leske's "Genus 1." Is it not clear, then, that it is no mistake of Leske's in calling *Echinarachnius* a species rather than a genus? He evidently intends to retain Klein's name *Arachnoides* for the genus, and as Klein gives no specific name, Leske proposes *echinarachnius*, but states that it is equivalent to *placenta*, L. Gray (1825, *op. cit.*) errs in attributing the genus *Echinarachnius* to Leske, for he was himself the first writer to use the name as a generic term. He includes three species in his genus—*placenta*, L., and *Scutella parma* and *lenticularis*, Lamk. In 1841 Agassiz restored *placenta* to the genus *Arachnoides* and put *lenticularis* in *Scutellina*, so that *parma* becomes the type of *Echinarachnius*. As *placenta* is the only

species in *Arachnoides*, it is obviously the type. There is room for difference of opinion as to whether *Arachnoides* should date from Leske or Agassiz; but as I have no doubt that the "Genus 1" of the former is *Arachnoides*, Klein, and as Leske himself uses that name on p. 8, it seems to me right to date the genus from the 'Additamenta.' Fourtau (1904) has attempted to substitute *Echinodiscus* for *Arachnoides*, but as his argument is based on the acceptance of pre-Linnean names, it does not concern us here. Ortman (1902) believes that *Echinarachnius* is not distinguishable from *Scutella*; but I cannot agree with him, for the differences between the petals of a typical *Scutella* (like *subrotunda*) and those of *Echinarachnius* are sufficiently important from the phylogenetic point of view to warrant generic separation, in spite of the existence of perplexing connecting forms. The genus *Dendraster* was proposed by Agassiz and Desor (1847) for the remarkable sand-dollar of the North Pacific called *Scutella excentrica* by Eschscholtz. In the 'Revision' this genus is considered a synonym of *Echinarachnius*; but I cannot believe this is desirable, for *excentrica* is quite unique in several important characters, and in my judgment *Dendraster* should be retained.

The genera *Peronella*, Gray, *Anomclanthus*, Bell, *Alexandria*, Pfeffer, and *Astriclypeus*, Verrill, were all monotypic when established, so there is no room for doubt as to their types. I am quite unable to follow Bell's (1883, Ann. & Mag. Nat. Hist., February) line of argument, by which he endeavours to dissociate *Peronella* from Gray. To my mind it is perfectly clear that Gray established *Peronella* as a subgenus for *Laganum peronii*, Agass. I am by no means clear as to the exact limits of *Peronella* as a generic term at the present day, but I am inclined to think it may well be used to include the species, otherwise referred to *Laganum*, which have only four genital pores.

In spite of their long-continued use, the genera *Eucope* and *Mellita*, so far as I can discover, have never had any types designated. For the former I would choose the species called *Echinodiscus emarginatus*, Leske, which seems to have been the longest known of any species. For *Mellita* I select *quinquiesperforatus*, Leske, both because it has page precedence over *sexiesperforatus* and because it seems to be a commoner and more generally known species. I greatly regret that the shorter and much more euphonious names given by Gmelin ten years later to these two species may not be used, but it would involve a deliberate violation of the Code. The fact that Leske wrote the specific name in two

parts, a numeral and a participle, might be construed as an indication that the full names (*Echinodiscus quinquies perforatus* or *5 perforatus* and *E. sexies perforatus* or *6 perforatus*) are not binomial, and this would clear the way for Gmelin's names; but this seems to me such an unworthy quibble, I cannot bring myself to adopt it.

Other genera which have been suggested at different times for Recent clypeastroids seem to me to lack sufficient reason for being. Thus the genera *Diplothecanthus* and *Plesianthus*, Duncan, are due to the recognition of the wrong type for *Clypeaster* and the laying of too much stress on the internal structure of *C. rosaceus*. *Mellitella* is based on a remarkable misconception by Duncan of the character of its type species, *Mellita stokesii* (Agassiz). He states that the lunules remain open as marginal slits. It is possible that he drew this conclusion from the figure given by A. Agassiz in the 'Revision'; but he would have avoided error had he read the description given in that work, for Agassiz distinctly says that the lunules may be completely closed, as in other species of *Mellita*. I may add here that I think there is no longer any good reason for doubting that *stokesii* is simply the young of *Eucope micropora*; hence *Mellitella* becomes a synonym of *Eucope*. The genus *Moulinia*—or *Moulinia* as emended by Duncan,—established by Agassiz in 1841 for a little clypeastroid from Martinique, is maintained by Duncan, 1885, although Lütken and A. Agassiz considered its type to be a young *Eucope*. A re-examination of the available evidence has satisfied me that Lütken and A. Agassiz were right, and I have therefore discarded the name.

The more one considers the various characters by which the families and genera of the clypeastroids are to be distinguished, the clearer it becomes that the position of the auricles and their relation to each other is of very great importance, although little weight has been attached to it hitherto. The condition of the actinal ambulacral furrows is also an important character, and fortunately is easily observed. The arrangement and relative size of the interambulacral plates are characters usually difficult to make out in adults, and as they are almost certainly correlated with the shape of the test, too much stress should not be laid on them. It is hard to decide how much weight may properly be given to the arrangement of the internal calcareous supports. It is hard to believe that it is of any great significance, and it seems almost certain that the differences are, in part at least, due to age. The distinction between

Echinocyamus and *Fibularia* is mainly in this character, and in these genera there is no reason to question the constancy and systematic value of the difference. But having satisfied myself that "*Mellita stokesii*" is only the young of *Eucope micropora*, I am bound to say that I consider the internal structure of the test of little taxonomic importance in the *Eucoptes* and their allies; and having found the greatest difficulty in making use of the character in *Clypeaster* and *Laganum*, I have practically ignored it.

The development of lunules in the more specialized clypeastroids affords an obvious, constant, and most interesting character; but how much weight is to be attached to their manner of formation we do not know. Is *Mellita series-perforatus* unique in the process of formation of its ambulacral lunules? What significance does its characteristic method have? Is it of taxonomic importance? Not being able to answer these questions, I suggest them as worthy of further investigation. The form of the petals is of course a good character, but it is well known that even a single species may show great diversity not only in the relative length and width, but in the degree of closure at the distal end. The position of the anus is an important character, but as it shows relatively little difference in adults it is only occasionally of practical value. The form of the test seems to be the most easily modified character, and little weight can be placed on it in determining relationships. Attention has been called by De Meijere to some interesting differences between the spines of *Laganum* and *Clypeaster*; but as I have not found it necessary to use this character and have not yet examined all the genera in this particular, I have nothing to add to his valuable account (1904, 'Siboga' Ech. pp. 103 *et seq.*). The pedicellariæ also show characters which may be useful for help in distinguishing species and genera, but they have not seemed to me of sufficient importance to take them into account here.

There can be little question that *Echinocyamus* and *Fibularia* belong in a family by themselves, but I do not think this can be considered a primitive group. Such simplicity of structure as they show is probably associated with their small size, while their fused auricles and the structure of the interambulacra strongly suggest relationship to *Laganum*.

In my judgment the most primitive of the Recent Clypeastroida is probably *Anomolanthus* or those species of *Clypeaster* with wide open petals such as *C. ravenellii*, A. Ag. In these forms the auricles are paired, well separated, and ambulacral

in position (this is assumed for *Anomolanthus*, as neither the describer of the unique type species nor the zoologist who established the genus refer to this most important character), there are five genital glands and pores, only slightly petaloid ambulacra, and small paired interambulacral plates in contact with each genital. In *Clypeaster* the interambulacra may become discontinuous in the adults, *i. e.* the primordial interambulacral plate becomes separated by ambulacral plates from the rest of the interambulacrum. It would be very interesting to know whether this is also true of *Anomolanthus*, for the high test and marginal anus of that genus show a less degree of specialization than is shown by any Recent *Clypeaster*.

With the increasing tendency to a subarenaceous life the depression of the test has gone on rapidly in the Clypeastroida, the extreme being reached in *Arachnoides placenta*. Curiously enough, however, except for the discontinuous interambulacra, doubtless associated with the flatness of the test, *Arachnoides* is otherwise quite a primitive form, as evidenced by the paired ambulacral auricles and the supra-marginal anus. The ambulacra, too, are only slightly petaloid. How the real relationships of this remarkable clypeastroid can best be shown is, of course, debatable, but it seems to be contrary to the evidence to separate it widely from *Clypeaster*, and yet I cannot believe it ought to be placed in the same family with that genus. I therefore recognize two distinct but nearly related families, the Clypeastridae and the Arachnoididae.

While *Arachnoides* is thus superficially very unlike *Clypeaster* but really nearly related, *Laganum* represents the other extreme, for it is superficially much like *Clypeaster* but in reality is quite different. In the fused auricles, interradially placed, and in the very narrow continuous interambulacra with a large and apparently (though not really) unpaired abactinal plate adjoining the genital, *Laganum* shows structural progress that makes it improper to place it in the same family with *Clypeaster*. The peculiar character of the interambulacra, combined with the straight, simple, actinal ambulacral furrows, prevents our placing it in the same family with *Scutella* and its allies, and it is therefore necessary to recognize the family Laganidae.

The remainder of the clypeastroids form quite a homogeneous group with more or less discoidal tests, fused auricles, interradially placed, interambulacra beginning abactinally in a pair of small plates next the genital, and with actinal ambulacral furrows more or less forked or

branched*. This group has long been known as the Scutellidæ, and while there are obvious reasons why it is preferable that the type genus of a family should, if possible, be one with Recent species, it would be worse than absurd to abandon this ancient and euphonious name for no better reason than that all known Scutellas are fossil.

We thus find it desirable to recognize five families, which seems like an excessive number for only fifteen genera, especially since eight of the genera clearly belong to one family. But I do not see how the number can be lessened without obscuring real relationships. The Clypeastridæ are almost certainly the nearest of the families to the original stock, and it is not hard to believe that the Laganidæ have had a common ancestry with them. The Fibulariidæ seem to have been derived from the Laganidæ, or from its near ancestor, by a process of simplification. The Arachnoididæ are certainly an old stock beginning on or near the Clypeastrid branch and with no near relatives at the present day. The Scutellidæ are quite a distinct branch, though their origin is probably very near that of the Laganidæ, if not identical with it.

The five families and their constituent genera may be distinguished by the following key. For convenience I have included *Scutella*, the type genus of the Scutellidæ, although it contains no Recent species.

- Auricles separate, each placed more or less clearly on the ambulacrum.
- Test not discoidal and seldom very flat; anus not supra-marginal; genital pores 5. (CLYPEASTRIDÆ.)
 - Poriferous areas of petals divergent, not incurved distally; anus marginal *Anomolanthus.*
 - Poriferous areas of petals more or less incurved distally; anus submarginal *Clypeaster.*
- Test exceedingly flat, discoidal; anus supra-marginal; genital pores 4. (ARACHNOIDIDÆ.)
 - With characters of the family *Arachnoides.*
- Auricles more or less fully fused into a single piece, situated on the interambulacrum.
- Actinal ambulacral furrows short and indistinct or

* They are not branched in *Alexandria*, and often only indistinctly so in *Echinarachnius*. Duncan's suggestion that *Alexandria* "appears to be an *Arachnoides* with a posterior notch" indicates that he neither read Pfeffer's description nor examined carefully the photograph given, in which the interambulacra may be seen to be continuous.

- wanting; abactinal end of each interambulacrum consists of a single large plate adjoining genital; test not usually discoidal and never with marginal slits or lunules.
- Petals more or less perfect; madreporic pores numerous; size moderate to large, 15 mm. and up in length. (LAGANIDÆ.)
- Genital pores present in all interradii *Laganum.*
- Genital pore wanting in posterior interradius. *Peronella.*
- Petals reduced and often rudimentary; only one madreporic pore; size small, rarely up to 15 mm. in length. (FIBULARIIDÆ.)
- Test more or less elevated, without internal radiating walls, except usually posteriorly. *Fibularia.*
- Test more or less flattened, with internal radiating walls bounding the ambulacra *Echinocyamus.*
- Actinal ambulacral furrows distinct, at least the posterior, and usually all, extending to ambitus; abactinal end of interambulacrum with the usual pair of small plates adjoining genital; test commonly more or less discoidal, often with marginal slits or lunules. (SCUTELLIDÆ.)
- Test without marginal slits or lunules.
- Actinal ambulacral furrows unbranched; genital pores 5; abactinal system very small *Alexandria.*
- Actinal ambulacral furrows more or less forked or branched; genital pores 4.
- Petals more or less nearly closed distally *Scutella.*
- Petals broadly open distally.
- Abactinal system at apex of test; anus marginal; petals subequal *Echinarachnius.*
- Abactinal system posterior to apex of test; anus on actinal surface; posterior petals much shorter than others *Dendraster.*
- Test with marginal slits or lunules or both.
- Not more than two marginal slits, and often none, in posterior half of test-margin.
- No lunule in posterior interambulacrum.
- Two lunules or marginal slits present, one in each posterior ambulacrum *Echinodiscus.*
- Five lunules present, one in each ambulacrum *Astriclypeus.*
- A lunule in posterior interambulacrum.
- Genital pores 5 *Eucope.*
- Genital pores 4 *Mellita.*
- More than eight marginal slits in posterior half of test-margin *Rotula.*

A list of these genera, with their types and other important data, follows:—

ANOMOLANTHUS, Bell, 1884. Proc. Zool. Soc. London, p. 43. Type, *Echinanthus tumidus*, Tenison-Woods, 1878, Proc. Linn. Soc. N.S.W. ii. p. 169. Monotypic.

CLYPEASTER, Lamarck, 1801. Syst. Anim. s. Vert. p. 349. Type, *Echinus rosaceus*, Linné, 1758, Syst. Nat. ed. 10, p. 665, = *Echinanthus rosaceus* of Gray, 1825, A. Agassiz, 1872, et al. Type fixed by elimination by Lamarck, 1816, Anim. s. Vert. iii. p. 13.

- ARACHNOIDES, Leske, 1778. Add. ad Klein, pp. 8 & 151. Type, *Arachnoides echinarachnius*, Leske, *l. c.*, = *Echinus placenta*, Linné, 1758, Syst. Nat. ed. 10, p. 666. Monotypic.
- LAGANUM, Gray, 1825. Ann. Phil. x. p. 5 (*Lagana*, by error). Type, *Echinodiscus laganum*, Leske, 1778, Add. ad Klein, p. 140, = *Laganum bonani*, Agassiz, 1841, and later writers. Type by tautonomy.
- PERONELLA, Gray, 1855. Cat. Recent Ech. pt. i. p. 13. Type, *Laganum peronii*, Agassiz, 1841, Mon. Scut. p. 123. Monotypic. Proposed as a subgenus.
- FIBULARIA, Lamarck, 1816. Anim. s. Vert. iii. p. 16. Type, *Fibularia trigona*, Lamarck, *l. c.*, = *Echinocyamus craniolaris*, Leske, 1778, Add. ad Klein, p. 150. Type fixed by elimination by Agassiz and Desor, 1847, Ann. Sci. Nat. (3) vii. p. 142. Since Agassiz and Desor's work permits either *trigona* or *ovulum* to be the type, I will designate the former, although I have no doubt both are synonyms of Leske's *Echinocyamus craniolaris*.
- ECHINOCYAMUS, Leske, 1778. Add. ad Klein, p. 149. Type, *Echinocyamus angulosus*, Leske, *op. cit.* p. 151, = *Echinus minutus*, Pallas, 1774, Spic. Zool. x. (usually quoted erroneously as ix.) p. 34, pl. i. fig. 25, as delimited by Leske, *op. cit.* pp. 150-152. Type fixed by elimination by Agassiz and Desor, 1847, Ann. Sci. Nat. (3) vii. p. 140.
- ALEXANDRIA, Pfeffer, 1881. Verhandl. Naturw. Ver. Hamburg von 1880, p. 63. Type, *Alexandria magnifica*, Pfeffer, *op. cit.* p. 64. Monotypic.
- SCUTELLA, Lamarck, 1816. Anim. s. Vert. iii. p. 7. Type, *Echinodiscus subrotundus*, Leske, 1778, Add. ad Klein, p. 142. Type fixed by elimination by Agassiz, 1841, Mon. Scut. p. 76.
- ECHINARACHNIUS, Gray, 1825. Ann. Phil. x. p. 6. Type, *Scutella parma*, Lamarck, 1816, Anim. s. Vert. iii. p. 11. Type fixed by elimination by Agassiz, 1841, Mon. Scut. p. 89.
- DENDRASTER, Agassiz and Desor, 1847. Ann. Sci. Nat. (3) vii. p. 135. Type, *Scutella excentrica*, Eschscholtz, 1831, Zool. Atlas, p. 19. Monotypic.
- ECHINODISCUS, Leske, 1778. Add. ad Klein, p. 131. Type, *Echinodiscus bisperforatus*, Leske, *op. cit.* p. 132. Type limited by Agassiz, 1841, Mon. Scut. p. 62 (under name *Lobophora*), to either *bisperforatus*, *auritus*, or *inauritus* of Leske, and the first, in the form of its second variety, has been selected by me in the present paper, p. 597.
- ASTRICLYPEUS, Verrill, 1867. Trans. Conn. Acad. i. p. 311. Type, *Astriclypeus manni*, Verrill, *l. c.* Monotypic.
- EUCOPE, Agassiz, 1841. Mon. Scut. p. 45. Type, *Echinodiscus emarginatus*, Leske, 1778, Add. ad Klein, p. 136. Type fixed in the present paper, p. 599.
- MELLITA, Agassiz, 1841. Mon. Scut. p. 34. Type, *Echinodiscus quinquesperforatus*, Leske, 1778, Add. ad Klein, p. 133. Type fixed in the present paper, p. 599.
- ROTULA, Agassiz, 1841. Mon. Scut. p. 23. Type, *Echinus orbiculus*, Linné, 1758, Syst. Nat. ed. 10, p. 266, as delimited by Leske, 1778, Add. ad Klein, pp. 133, 144, 146, = *Rotula rumphii*, Agassiz, 1841, and later writers. Type by virtual tautonomy.

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